

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets

(11)

EP 0 774 888 A3



(12)

## EUROPEAN PATENT APPLICATION

(88) Date of publication A3:  
07.10.1998 Bulletin 1998/41

(51) Int. Cl.<sup>6</sup>: H05K 1/18, H05K 1/16

(43) Date of publication A2:  
21.05.1997 Bulletin 1997/21

(21) Application number: 96118388.6

(22) Date of filing: 15.11.1996

(84) Designated Contracting States:  
DE FR GB

(72) Inventor: Nishiyama, Tousaku  
Uda-gun, Nara 632-02 (JP)

(30) Priority: 16.11.1995 JP 298328/95

(74) Representative:  
VOSSIUS & PARTNER  
Siebertstrasse 4  
81675 München (DE)

(71) Applicant:

MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD  
Kadoma-shi, Osaka 571 (JP)

### (54) Printing wiring board and assembly of the same

(57) A printed wiring board (PWB) and assembly are described which are suitable for high density mounting of an electronic component and which can provide a thin and light assembly. A recess (10) is formed in one part of a PWB (1) and components (4, 4') are received in this recess (10). The components (4, 4') are lower than the surface of the PWB (1). A conductive pad (3) is provided to the bottom of the recess (10) and a connect-

ing terminal (4a) and the conductive pad (3) are electrically connected by using a solder ball (11) or a conductive adhesive material. The recess (10) is formed by partially removing one or more layers of plural conductive layers and insulating layers which make up the multilayer PWB (1).

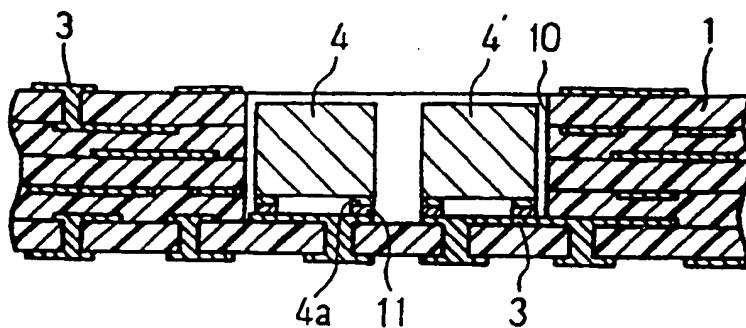


FIG. 9



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	PATENT ABSTRACTS OF JAPAN vol. 15, no. 86 (E-1039), 28 February 1991 & JP 02 301182 A (MATSUSHITA ELECTRIC IND CO), 13 December 1990, * abstract *	1	H05K1/18 H05K1/16
Y	---	3,8,9	
Y	PATENT ABSTRACTS OF JAPAN vol. 9, no. 31 (E-295), 9 February 1985 & JP 59 175150 A (SHARP KK), 3 October 1984, * abstract *	3	
Y	---		
X	DE 40 22 829 A (VOGT) 23 January 1992 * column 7, line 19 - line 28; figure 3 *	8	
X	PATENT ABSTRACTS OF JAPAN vol. 17, no. 676 (E-1475), 13 December 1993 & JP 05 226803 A (MATSUSHITA ELECTRIC WORKS), 3 September 1993, * abstract *	1,2	
X	EP 0 586 069 A (SAMSUNG ELECTRONICS CO) 9 March 1994 * figure 5 *	1,2	
A	---	3	
X	PATENT ABSTRACTS OF JAPAN vol. 14, no. 278 (E-0941), 15 June 1990 & JP 02 087695 A (MITSUBISHI ELECTRIC CORP), 28 March 1990, * abstract *	1,2,5	
	---	-/--	
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search		Examiner
THE HAGUE	17 July 1998		Mes, L
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			
EPO FORM 1503 03/82 (Rev 4/91)			



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	PATENT ABSTRACTS OF JAPAN vol. 14, no. 194 (E-0919), 20 April 1990 & JP 02 039587 A (OKI ELECTRIC IND CO), 8 February 1990, * abstract *	1,4	
X	---		
X	PATENT ABSTRACTS OF JAPAN vol. 15, no. 22 (E-1024), 18 January 1991 & JP 02 268489 A (TOYO COMMUN EQUIP CO), 2 November 1990, * abstract *	1,5,6	
X	---		
X	PATENT ABSTRACTS OF JAPAN vol. 15, no. 22 (E-1024), 18 January 1990 & JP 02 268490 A (TOYO COMMUN EQUIP CO), 2 November 1990, * abstract *	1,5	
X	---		
X	WO 95 03683 A (OAKLEIGH SYSTEMS) 2 February 1995 * figure 4 *	1,2	
X	---		
X	US 5 386 343 A (PAO) 31 January 1995 * figures *	1,4	
X	---		
X	PATENT ABSTRACTS OF JAPAN vol. 17, no. 559 (E-1445), 7 October 1993 & JP 05 160540 A (SEIKO EPSON CORP), 25 June 1993, * abstract *	1-3,14, 16	
X	---		
X	EP 0 607 532 A (JAPAN RADIO CO.) 27 July 1994 * figure 12 *	10-12	
Y	---	13	
	---	-/--	
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		17 July 1998	Mes, L
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone			
Y : particularly relevant if combined with another document of the same category			
A : technological background			
O : non-written disclosure			
P : intermediate document			
T : theory or principle underlying the invention			
E : earlier patent document, but published on, or after the filing date			
D : document cited in the application			
L : document cited for other reasons			
& : member of the same patent family, corresponding document			



DOCUMENTS CONSIDERED TO BE RELEVANT									
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)						
A	EP 0 645 951 A (MATSUSHITA ELECTRIC INDUSTRIAL CO.) 29 March 1995 * abstract; figure 6; example 5 *	12							
Y		9, 13, 24							
X	PATENT ABSTRACTS OF JAPAN vol. 18, no. 406 (E-1585), 28 July 1994 & JP 06 120670 A (JAPAN RADIO CO), 28 April 1994, * abstract *	10-12							
X	US 5 116 440 A (TAKEGUCHI ET AL.) 26 May 1992 * abstract; figures *	10, 11							
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 330 (E-793), 25 July 1989 & JP 01 093198 A (SHINKO ELECTRIC IND CO), 12 April 1989, * abstract *	10, 11							
A	---	12							
X	PATENT ABSTRACTS OF JAPAN vol. 15, no. 86 (E-1039), 28 February 1991 & JP 02 301183 A (TOSHIBA CORP), 13 December 1990, * abstract *	10, 11, 14, 15, 17, 21							
Y	---	23, 24							
Y	PATENT ABSTRACTS OF JAPAN vol. 18, no. 116 (E-1515), 24 February 1994 & JP 05 315337 A (MATSUSHITA ELECTRIC IND CO), 26 November 1993, * abstract *	23							
	---	-/-							
<p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of completion of the search</td> <td style="width: 34%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>17 July 1998</td> <td>Mes, L</td> </tr> </table> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>				Place of search	Date of completion of the search	Examiner	THE HAGUE	17 July 1998	Mes, L
Place of search	Date of completion of the search	Examiner							
THE HAGUE	17 July 1998	Mes, L							



## EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	PATENT ABSTRACTS OF JAPAN vol. 18, no. 202 (E-1535), 8 April 1994 & JP 06 006043 A (TANAKA KIKINZOKU KOGYO KK), 14 January 1994, * abstract *---	10,11, 14,15,17
X	PATENT ABSTRACTS OF JAPAN vol. 96, no. 2, 29 February 1996 & JP 07 254766 A (AKAI ELECTRIC CO), 3 October 1995, * abstract *---	10,11, 14,15,17
X	PATENT ABSTRACTS OF JAPAN vol. 95, no. 4, 31 May 1995 & JP 07 030059 A (NEC CORP), 31 January 1995, * abstract *---	10,11, 14,15,17
X	PATENT ABSTRACTS OF JAPAN vol. 96, no. 2, 29 February 1996 & JP 07 283335 A (IBIDEN CO), 27 October 1995, * abstract *---	10,11, 14,15
X	PATENT ABSTRACTS OF JAPAN vol. 16, no. 8 (E-1152), 10 January 1992 & JP 03 230597 A (MITSUBISHI ELECTRIC CORP), 14 October 1991, * abstract *---	10,11,14
X	PATENT ABSTRACTS OF JAPAN vol. 9, no. 39 (E-297), 19 February 1985 & JP 59 181650 A (CANON KK), 16 October 1984, * abstract *---	10,11, 14,15,21
		-/--
The present search report has been drawn up for all claims		
Place of search	Date of completion of the search	Examiner
THE HAGUE	17 July 1998	Mes, L
CATEGORY OF CITED DOCUMENTS		
X : particularly relevant if taken alone	T : theory or principle underlying the invention	
Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date	
A : technological background	D : document cited in the application	
O : non-written disclosure	L : document cited for other reasons	
P : intermediate document	& : member of the same patent family, corresponding document	



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)	
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)	
X	L.M. LEHRER ET AL.: "Low profile IC packaging method" MOTOROLA TECHNICAL DEVELOPMENTS., vol. 15, May 1992, SCHAUMBURG, ILLINOIS US, page 166 XP000306197 * the whole document *	10,11, 14,22		
X	PATENT ABSTRACTS OF JAPAN vol. 17, no. 313 (E-1381), 15 June 1993 & JP 05 029747 A (AKAI ELECTRIC CO), 5 February 1993, * abstract *	10,11,14		
X	PATENT ABSTRACTS OF JAPAN vol. 17, no. 50 (E-1314), 29 January 1993 & JP 04 263493 A (IBIDEN CO), 18 September 1992, * abstract *	10,11,14		
A	US 5 274 701 A (SCHMIDT ET AL.) 28 December 1993 * abstract; figures *	25	TECHNICAL FIELDS SEARCHED (Int.Cl.6)	
A	US 4 188 513 A (MORRELL ET AL.) 12 February 1980 * abstract; figures *	25		
A	DE 33 46 461 A (SIEMENS AG) 4 July 1985 * abstract; figures *	25		
		-/-		
The present search report has been drawn up for all claims				
Place of search	Date of completion of the search	Examiner		
THE HAGUE	17 July 1998	Mes, L		
CATEGORY OF CITED DOCUMENTS				
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background C : non-written disclosure P : intermediate document				
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document				



European Patent  
Office

## EUROPEAN SEARCH REPORT

**Application Number**

EP 96 11 8388.

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	<p>DATABASE WPI Week 8536 Derwent Publications Ltd., London, GB; AN 85-221479 XP002071894 &amp; JP 53 070 425 A (TOPPAN PRINTING CO), 22 June 1978 * abstract *</p> <p>-----</p>	29	
TECHNICAL FIELDS SEARCHED (Int.Cl.6)			
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	17 July 1998	Mes, L	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone	T : theory or principle underlying the invention		
Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date		
A : technological background	D : document cited in the application		
O : non-written disclosure	L : document cited for other reasons		
P : intermediate document	& : member of the same patent family, corresponding document		

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



European Patent  
Office

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

EP 96118388.6 - B -

1. Claims 1-9: Component thinner than printed wiring board in opening of printed wiring board
2. Claims 10-13: Multilayer printed wiring board having recess by laminating
3. Claims 14-24: Component connected to pads on bottom portion of recess in printed wiring board
4. Claims 25-29: Printed wiring board having vibration film over recess

**THIS PAGE BLANK (USPTO)**